



## Corporate environmental initiatives in the Chinese context: Performance implications and contextual factors

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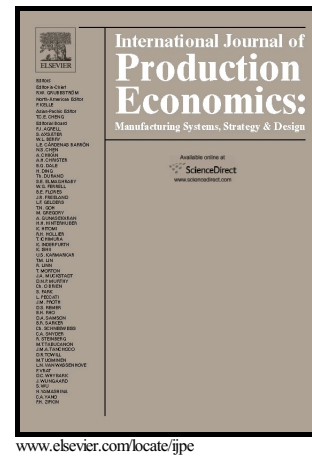
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Corporate Environmental Initiatives in the Chinese Context:  
Performance Implications and Contextual Factors

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## Abstract

Although a number of studies have been conducted on the relationship between environmental management and firm performance, most of them are conducted in the Western context. Due to the unique social and economic environments in China, the performance implications of environmental management might be quite different in the Chinese context. We examine the impact of corporate environmental initiatives (CEIs) on the market value of firms in China. We find that, in contrast to the findings in the Western context, Chinese investors react negatively to CEI announcements. The negative reaction is more significant when the announcements are related to processes rather than products, and for state-owned enterprises rather than privately-owned corporations. However, there is no difference whether the CEI is self-declared or third-party endorsed. Overall, our research indicates that Chinese investors consider CEIs to be in conflict with shareholder interest. In particular, CEIs in state-owned enterprises might be considered by investors as signals that firms need to sacrifice profits to shoulder more social responsibility.

## 1. Introduction

The financial implications of firms' environmental practices have attracted researchers' attention for years (Klassen and McLaughlin, 1996; Lucas and Noordewier, 2016). Various studies have been conducted to address a simple yet important question: Does it pay to be green? (Dixon-Fowler et al., 2013; Hart and Ahuja, 1996; Stefan and Paul, 2008). A common approach employed to answer this question is the event study methodology, which quantifies stock market reactions to the announcements of corporate environmental initiatives (CEIs) (Gilley et al., 2000; Jacobs et al., 2010). While the event study results vary, some recent reviews observe that "it pays to be green" has become the predominant finding among studies (Endrikat, 2015; Molina-Azorín et al., 2009). However, these reviews also find that as prior studies have mainly focused on Western countries, especially in the US context, "further research on non-US firms is needed to assess whether the mainstream results are consistent with findings for other countries" (Blanco et al., 2009, p. 498).

Such a concern is especially valid in the context of developing countries such as China, in which environmental regulations and customers' preferences are quite different from those in the US and other Western countries (Economy and Lieberthal, 2007; Hsu et al., 2014; Marquis et al., 2011; Zhu, 2015). As a result, it is questionable whether the predominant finding that "it pays to be green" still holds in the Chinese context. Moreover, while it is important to understand whether it pays to be green, recent reviews have pointed out that it is even more critical to explain when it pays to be green in order to provide more insightful implications for theory and practice (Dixon-Fowler et al., 2013). Therefore, our research attempts to investigate whether and when it pays to be green in China.

Conducting an event study of 556 CEI announcements of Chinese firms over a ten-year period 2005 to 2014, we find that Chinese investors react negatively to CEI announcements. More specifically, over a two-day event window from the event day to the day after the event (i.e., days 0 to 1), the mean and median cumulative abnormal returns (CARs) are -0.28% and -0.33%, respectively. Moreover, the CARs are statistically significant based on the t-test ( $p < 0.05$ ) and Wilcoxon signed-rank test ( $p < 0.01$ ).

We then adopt signalling theory to explore when it pays to be green in China. Signalling theory

suggests that in the situation of information asymmetry, one party may need to rely on some observable signals sent by another party to interpret the underlying capabilities of the latter (Connelly et al., 2011). Applying to our research context, the extent to which Chinese investors value CEIs may depends on how they view the observable signals contained in CEI announcements. Signalling theory thus enables us to hypothesize how the observable characteristics of CEIs and firms may send different signals to Chinese investors, resulting in different stock market reactions to firms' CEI announcements. Consistent with our signalling logic, we find that the stock market reactions are more negative for process-focused (rather than product-focused) CEIs and state-owned (rather than privately-owned) firms. However, there is no difference in stock returns between self-declared and third-party certified CEIs.

Our research is important in several ways. First, while the financial implications of CEIs have been well studied in the Western context (Gilley et al., 2000; Jacobs et al., 2010), little is known about how stock markets may react to Chinese firms' CEI announcements. Our research fills this gap by documenting the CARs of 556 CEI announcements in China over a ten-year period 2005 to 2014. Moreover, the negative CARs found in our research challenge the pervasive claim that "it pays to be green" (Endrikat, 2015; Molina-Azorín et al., 2009) and highlight the importance of taking the national context into account when studying the financial implications of CEIs.

In addition to the main effect, our research also documents how stock market reactions could vary across different CEIs and firms. These findings enable practitioners to gain a better understanding of not only whether but also when it pays to be green in China. Finally, the signalling perspective adopted in our research may offer a fruitful theoretical foundation for future research on CEIs.

## 2. Literature and Hypothesis Development

### 2.1. CEIs and their impacts on financial performance

Consistent with prior studies (e.g., Gilley et al., 2000; Jacobs et al., 2010), we define CEIs as firms' efforts to reduce the negative environmental impact or to enhance the positive environmental benefit of their products or processes. CEIs can be either process-focused, such as the implementation of

green manufacturing systems, or product-focused, such as the introduction of eco-friendly products (Aragon-Correa and Sharma, 2003; Christmann, 2000). On the other hand, firms can decide whether third-party verification or certification is involved in their CEIs (Jacobs et al., 2010). For instance, firms may implement environmental management systems with or without third-party certification (e.g., ISO 14001).

The links between CEIs and financial performance have been well studied in the Western context (e.g., Gilley et al., 2000; Jacobs et al., 2010; Klassen and McLaughlin, 1996; Wassmer et al., 2014). Prior studies on CEIs commonly agree that CEIs can help firms improve financial performance through two different mechanisms, namely cost reduction and revenue gain (Jacobs et al., 2010). First, CEIs are able to reduce costs because of the consumption of less energy and material, migration of environmental risks and crises, and avoidance of environmental lawsuits and legal settlements. On the other hand, CEIs enable firms to increase revenues by enhancing the loyalty of existing customers, attracting new and environmentally sensitive customers, and earning higher margins for eco-friendly products. These arguments have gained empirical support in the literature (see, e.g., Albertini, 2013; Dixon-Fowler et al., 2013; Molina-Azorín et al., 2009). In particular, a recent meta-analytic review shows positive relationships between CEIs and stock market reactions across prior studies (Endrikat, 2015).

Researchers increasingly adopt the event study methodology to investigate how Chinese investors react to various corporate events or initiatives such as mergers and acquisitions (Gaur et al., 2013), marketing channel expansions (Homburg et al., 2014), IT investments (Meng et al., 2007), and product recalls (Zhao et al., 2013). After an extensive search, we identify some related event studies concerning environmental management in China (e.g., Kong et al., 2014; Lyon et al., 2013; Xu et al., 2012) and discuss how they are different from our research on Chinese firms' environmental initiatives. For instance, Kong et al. (2014) studied the impact of an environmental policy (i.e., the carbon emission rights trading scheme (CERTS) announced on 29 October 2011), rather than corporate initiatives, on the market value of Chinese firms. On the other hand, Xu et al. (2012) investigated how stock markets react to Chinese firms' environmental violation events, rather than

their environmental protection efforts. Finally, Lyon et al. (2013) examined stock market reactions to environmental awards initiated by a third-party in China (i.e., China Entrepreneur Club), rather than the environmental efforts initiated by Chinese firms themselves. Therefore, to the best of our knowledge, our research represents one of the first attempts to quantify stock market reactions to CEI announcements in China.

On the other hand, due to the different environmental regulations and customers' preferences in China (Economy and Lieberthal, 2007; Marquis et al., 2011), it is questionable whether the positive relationships between CEIs and stock market reactions found in Western countries (Endrikat, 2015) still hold in the Chinese context. Some prior event studies (e.g., Lyon et al., 2013; Xu et al., 2012), although different from our research, have raised the same concern. For instance, Lyon et al. (2013) found that winning environmental awards in China has no effect and, in some cases, even has a negative impact on shareholder value; Xu et al. (2012) revealed that environmental violation events have less negative effects on the market value of Chinese firms, compared with firms in other developed countries. Therefore, Chinese investors may not appreciate the cost reduction and revenue gain mechanisms of CEIs in China for various reasons.

First, CEIs may not be regarded as an attractive option for Chinese firms to reduce cost. As the environmental regulations in China are less stringent compared with those in Western countries such as the US (Dixon-Fowler et al., 2013), Chinese firms "find it cheaper simply to pay fines than to adhere to the regulations" (Economy and Lieberthal, 2007, p. 93). Moreover, competition for economic growth among different areas in China results in lax enforcement of the environmental regulations by local governments (Marquis et al., 2011), making it less likely to punish environmentally irresponsible but economically important firms. As a result, instead of reducing cost, CEIs may be viewed as costly investments for Chinese firms.

On the other hand, Chinese firms may not benefit from CEIs in terms of revenue gain. Chinese customers are less environmentally aware compared with their counterparts in Western countries (Hsu et al., 2014). As a result, they may not view products' environmental impacts as an important consideration in their buying decision process. Moreover, due to the significant differences in



individual incomes between China and Western countries (Malik, 2013), Chinese customers are more price-sensitive and thus may prefer products with lower prices rather than with better environmental performance. Given that the cost reduction and revenue gain mechanisms of CEIs may have opposite effects in Chinese firms compared with those in the Western economies, we expect negative, rather than positive, stock market reactions to CEI announcements of Chinese firms. Therefore, we propose that

H1. Stock markets react negatively to Chinese firms' CEI announcements.

## 2.2. A signalling perspective on stock market reactions to CEIs in China

Although we expect a negative impact of CEIs on shareholders' value in the Chinese context, the magnitude of this impact may depend on the specific CEIs and firms concerned. Some recent reviews (e.g., Dixon-Fowler et al., 2013; Endrikat, 2015) have also urged researchers to move from simply answering "does it pay to be green?" to gaining a better understanding of "when does it pay to be green?" Accordingly, we adopt signalling theory to explore how the characteristics of CEIs and firms in China may send different signals to investors regarding the cost reduction and revenue gain opportunities of CEIs, thus resulting in different stock market reactions.

Signalling theory applies to the situation of asymmetric distribution of information between two parties in which certain underlying capabilities of one party are unobservable to the other party (Connelly et al., 2011; Neto et al., 2016). In the case of CEIs in China, when a firm announces its CEI, the cost reduction and revenue gain capabilities of the CEI may be not easily unobserved by external investors. Signalling theory suggests that in this situation, the latter may need to rely on other observable characteristics of the former to interpret the former's underlying capabilities (Gao et al., 2010). As a result, investors may rely on other observable characteristics of the particular firm and CEI concerned to interpret the financial consequences of the firm's CEI.

We first consider how the focuses of firms' CEIs may send different signals to investors, leading to different stock market reactions. Firms' CEIs can be focused on either processes or products (Aragon-Correa and Sharma, 2003; Christmann, 2000): while process-focused CEIs centre on

operational processes such as manufacturing systems and logistics activities, product-focused CEIs concern the environmental impact of firms' products and services (Gilley et al., 2000). Due to such a difference, prior studies suggest that firms implement process-focused CEIs to reduce cost whilst product-focused CEIs to increase revenue (Albertini, 2013; Christmann, 2000). In the context of China, investors may view process-focused CEIs as less effective compared with product-focused CEIs for several reasons. First, although the environmental regulations in China have become more stringent in recent years and some local governments have begun to redouble enforcement of regulations (Marquis et al., 2011), firms can move their processes to other areas with lax enforcement of regulations rather than to improve the environmental performance of their existing processes, making process-focused CEIs a less favourable choice for firms to reduce cost. On the other hand, as a result of improved environmental education and increased personal incomes of Chinese customers in recent years (Hays, 2014), some Chinese customers may be willing to pay more for and/or buy more eco-friendly products, benefiting firms with product-focused CEIs. Finally, because of their different focuses, process-focused CEIs are less visible to firms' stakeholders compared with product-focused CEIs (Gilley et al., 2000). Signalling theory also emphasizes the importance of signal visibility because "signals that are more visible are more effective" (Connelly et al., 2011, p. 48). The invisibility of process-focused CEIs becomes even more prominent in the context of China where information is less transparent compared with in Western countries (Williams, 2015), thus making it difficult for investors to value the financial benefits of Chinese firms' process-focused CEIs. Therefore, we propose that

H2. The stock market reactions to Chinese firms' CEI announcements are more negative when the CEIs are process-focused rather than product-focused.

We then consider how the ownership of the announcing firms may signal different objectives of their CEIs, thus affecting stock market reactions. Compared with privately-owned firms, state-owned firms in China bear other political and social responsibilities beyond creating shareholder wealth (Chen et al., 2010; Cui and Jiang, 2012; Zhu et al., 2016). As a result, state-owned firms may not view

CEIs as tools to reduce cost or to increase revenue, but as tasks assigned by the central or local government. For instance, Chongqing Iron and Steel Company Limited, a state-owned Chinese firm, relocated its factories in response to the local government's environmental improvement policy, even though the relocation "caused the amount of liability increased and the finance costs rose sharply" (ET Net News Agency, 2015). On the other hand, privately-owned firms are more concerned about maximizing shareholders' value (Friedman, 1970; Kramer, 2012). As a result, their CEIs, if implemented, are more likely to aim for creating shareholder wealth, through either cost reduction or revenue gain. Due to such a difference in the objectives of implementing CEIs, we expect that state-owned firms' shareholders may benefit less from CEIs compared with those of privately-owned firms. Therefore, we propose that

H3. The stock market reactions to Chinese firms' CEI announcements are more negative when the firms are state-owned rather than privately-owned.

Finally, we are interested in knowing whether third-party assessment or certification increases signal credibility, thus resulting in more favourable stock market reactions. While firms can implement CEIs with or without the involvement of independent third parties, prior studies (e.g., Cordeiro and Tewari, 2015; Jacobs et al., 2010; Klassen and McLaughlin, 1996) argued that third-party assessment or certification, usually requiring detailed documentation, extensive examination, and objective evidence, conveys more creditable signals regarding firms' CEIs, and thus are more likely to be valued by investors. Empirically, researchers have documented the positive financial impact of various types of third-party environmental certifications or awards such as the certification of environmental management systems (de Jong et al., 2014), environmental awards (Klassen and McLaughlin, 1996), and environmental rankings (Cordeiro and Tewari, 2015). The signalling effects of third-party certification may be particularly important in the context of China in which corporate information is less transparent (Williams, 2015). As a result, third-party certification may help reduce investors' uncertainty about Chinese firms' CEIs, thus leading to better stock market reactions. Therefore, we propose that

H4. The stock market reactions to Chinese firms' CEI announcements are less negative when the CEIs are third-party certified rather than self-declared.

### 3. Methods

#### 3.1. Data collection

We collect and combine longitudinal data from multiple sources to construct our research variables. First, we obtained Chinese firms' announcements of CEIs from a news database named WiseNews. WiseNews is the world's largest Chinese news database, which covers more than 1,900 Chinese newspapers and magazines such as Shanghai Securities News, China Securities Journal, and Secutimes, and has been widely used in prior studies regarding China (e.g., Cheung et al., 2004; Du, 2016). To provide a more comprehensive view of firms' CEIs in China, we searched WiseNews in the ten-year period 2005 to 2014. Moreover, we limited our search to public firms that were included in the CSI 300 index from 2005 to 2014 for two reasons. First, the CSI 300 index consists of the 300 largest and most liquid Chinese stocks that are widely covered by various news media, thus reducing the bias of news coverage. Second, the CSI 300 index can be used as the market return in the Market model discussed below, allowing a more precise estimation of sample firms' abnormal returns upon their CEI announcements. Similar to prior CEI studies conducted in the Western context (e.g., Gilley et al., 2000; Jacobs et al., 2010), our search in WiseNews contained the names of the firms under study and the Chinese versions of the relevant keywords such as environment, green, ecosystem, recycle, and waste reduction. We read through the text of the searched results from WiseNews and excluded news articles that were (1) not directly related to CEIs such as public opinion on environmental issues and governments' environmental policies, (2) concerned with firms that were not the constituents of the CSI 300 index, (3) duplicate reports of the same CEIs in different news media, or (4) confounded with other corporate events such as key executive appointments and annual earnings announcements. After elimination, we obtained 656 CEIs announced by 169 firms.

We then obtained the daily stock returns of these sample firms from the China Stock Market and Accounting Research (CSMAR) database to analyze the stock market reactions to their CEI

announcements. The CSMAR database contains the stock return data of all the firms publicly traded in China since 1990, and has been widely used in prior event studies concerning Chinese firms (e.g., Calomiris et al., 2010; Xu et al., 2012). The CSMAR database also provides the ownership data of these public firms, which enable us to determine whether our sample firms are state-owned or privately-owned (Chen et al., 2010; Wang and Li, 2015). In addition, we relied on the news articles collected from WiseNews to determine whether the specific CEIs concerned were process-focused or product-focused, and whether they were third-party certified or self-declared. Table 1 summarizes the data sources of the key variables used in our research.

--- Table 1 about here ---

### 3.2. Event study methodology

We employ the event study methodology (MacKinlay, 1997; McWilliams and Siegel, 1997) to quantify stock market reactions to CEI announcements, which is known as abnormal returns (ARs). Basically, ARs are the differences between the actual stock returns with the occurrence of events such as CEI announcements and the expected stock returns had there been no such events. Following prior event studies (e.g., Jacobs et al., 2010; Zhao et al., 2013), we estimate the expected stock returns based on the Market model shown in equation (1). Specifically, we first regress the stock returns ( $R_{it}$ ; the returns of firm  $i$  on day  $t$ ) on the market returns ( $RM_t$ ; the returns of the CSI 300 index on day  $t$ ) over a 200-day estimation period ending 11 days prior to the CEI announcements (Jacobs et al., 2010).

$$R_{it} = \alpha_i + \beta_i RM_t + \varepsilon_{it} . \quad (1)$$

With the estimates  $\hat{\alpha}_i$  and  $\hat{\beta}_i$  obtained from the estimation period, we calculate the expected stock returns ( $E(R_{it})$ ) had there been no CEI announcements:

$$E(R_{it}) = \hat{\alpha}_i + \hat{\beta}_i RM_t . \quad (2)$$

As a result, the abnormal returns ( $AR_{it}$ ) due to the CEI announcements can be computed as the difference between the actual stock returns ( $R_{it}$ ) and the expected stock returns ( $E(R_{it})$ ):

$$AR_{it} = R_{it} - E(R_{it}) = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i RM_t) . \quad (3)$$

Prior studies (e.g., MacKinlay, 1997; McWilliams and Siegel, 1997) suggest calculating the cumulative abnormal returns (CARs) around the event dates (i.e., over an event window) in order to capture the full impact of the event. Following prior event studies (e.g., Ba et al., 2013; Wassmer et al., 2014), we choose three trading days around the event dates (i.e., day -1 to +1) as the event window to account for possible information leakages before the event and possible announcements made after stock market closures. Our final sample for the event study reduces from 656 to 556 as the stock return data of some firms are not available in the 200-day estimation period or the three-day event window. Consistent with prior event studies (e.g., Gilley et al., 2000; Jacobs et al., 2010), we apply both parametric test (i.e., the t-test) and non-parametric test (i.e., the Wilcoxon-signed rank test) to analyze the statistical significance of ARs and CARs.

### 3.3. Cross-sectional regression analysis

Consistent with prior event studies (e.g., Ba et al., 2013; Flammer, 2013; MacKinlay, 1997), we construct a cross-sectional regression model as shown below to analyze how CARs may vary across different CEIs and firms. The use of regression enables us to control for other firm-, industry-, and time-specific factors that may be related to CARs.

$$\begin{aligned} \text{CARs}_i = & \beta_0 + \beta_1 \text{Process-focused or product-focused CEIs}_i \\ & + \beta_2 \text{State-owned or privately-owned firms}_i \\ & + \beta_3 \text{Third-party certified or self-declared CEIs}_i + \beta_4 \text{Firm Size}_i \\ & + \beta_5 \text{Firm Profitability}_i + \beta_6 \text{Time Trend}_i + \text{Industry Dummies} + \varepsilon_i. \end{aligned} \quad (4)$$

CARs are based on the empirical findings from the event study that are able to “capture the significant effect of the event” (McWilliams and Siegel, 1997, p. 636). Consistent with prior CEI research (e.g., Aragon-Correa and Sharma, 2003; Christmann, 2000; Gilley et al., 2000), we code process-focused CEIs such as those reducing the use of hazardous materials in manufacturing processes and redesigning production systems to lower their environmental impact as 1, and product-focused CEIs such as those creating new types of environmentally-friendly products and reducing the environmental impact of existing products as 0. Following prior studies in the Chinese

context (e.g., Chen et al., 2010; Wang and Li, 2015), we regard a Chinese firm as state-owned if it is ultimately owned or controlled by the central or local government (coded as 1), and privately-owned otherwise (coded as 0). Finally, we code third-party certified CEIs such as environmental awards and certifications as 1, and self-declared CEIs as 0 (Jacobs et al., 2010).

We control for firm size and firm profitability in the regression model as they may be related to CARs (Flammer, 2013; Gilley et al., 2000; Jacobs et al., 2010). We measure firm size as the natural logarithm of total assets (Flammer, 2013) and firm profitability as return on assets (Tang et al., 2016). We also include time trend and industry dummies to account for unobserved time and industry effects. Time trend is measured as the difference between a CEI's announcing year and 2005 (Flammer, 2013), while industry dummies are coded based on the industry classification compiled by the China Securities Regulatory Commission (Lo et al., 2010).

## 4. Results

### 4.1. The abnormal returns of CEIs

The test results of abnormal returns are presented in Table 1. Panel A of Table 1 shows the abnormal returns on individual days around the CEI announcements (i.e., days -1, 0, and +1, respectively). Although the abnormal returns on day -1 are not statistically significant ( $p > 0.1$  for both the t-test and Wilcoxon signed-rank test), they become significant on both days 0 and +1 ( $p < 0.1$  for the t-test and  $p < 0.01$  for the Wilcoxon signed-rank test). This suggests that there is no evidence of information leakage before CEI announcements but possible announcements made after stock market closures. Such a pattern of stock market reactions is consistent with prior research conducted in the Chinese context (e.g., Zhao et al., 2013). Moreover, the mean and median abnormal returns on both days 0 and +1 are negative, indicating that investors react negatively to CEI announcements of Chinese firms. The cumulative abnormal returns (CARs) shown in Panel B of Table 1 provide further evidence. In particular, the mean and median CARs over both the two-day (i.e., days -1 to 0 and days 0 to +1) and three-day (i.e., days -1 to +1) event windows are negative, while both the t-test ( $p < 0.05$ ) and Wilcoxon signed-rank test ( $p < 0.01$ ) are significant for the CARs from days 0 to +1. Therefore, H1 is

supported.

--- Table 2 about here ---

#### 4.2. Cross-sectional regression results

As the stock market does not react significantly on day -1 ( $p > 0.1$  for both the t-test and Wilcoxon signed-rank test), we rely on the CARs from days 0 to +1 as the dependent variable in our cross-sectional regression analysis. In fact, Panel B of Table 1 shows that the mean and median CARs from days 0 to +1 are more negative than those from days -1 to +1, suggesting that a two-day window (i.e., days 0 to +1) is “long enough to capture the significant effect of the event” (McWilliams and Siegel, 1997, p. 636).

--- Table 3 about here ---

--- Table 4 about here ---

Table 3 shows the correlations among all the variables included in our regression analysis while Table 4 presents the regression results. In Table 4, Model 1 is the basic model including all the control variables and industry dummies. Models 2 to 4 add the three hypothesized variables, sequentially, to Model 1. All the four models are significant ( $F \geq 1.594$ ,  $p < 0.01$ ) with adjusted R-squares ranging from 0.054 to 0.074. The number of observations in all the four models is 551, which is reduced from 556 in Table 2 due to missing data for some control variables.

Two control variables, namely firm profitability and time trend, remain significant ( $p < 0.1$ ) across the four models. While firm profitability is negatively related to CARs, time trend is positively related to CARs. This suggests that investors react more negatively to CEIs announced by more profitable firms but react more positively to CEIs announced in recent years. The first hypothesized variable, process-focused or product-focused CEIs, is negative and significant ( $p < 0.05$ ) from Models 2 to 4, indicating that the abnormal returns are more negative when CEIs are process-focused rather than product-focused. Therefore, H2 is supported. Moreover, the second hypothesized variable, state-owned or privately-owned firms, is also negative and significant ( $p < 0.01$ ) in Models 3 and 4. This shows that the stock market reacts more negatively to CEIs announced by state-owned rather



than privately-owned firms, supporting H3. The final hypothesized variable, third-party certified or self-declared CEIs, is positive but not statistically significant ( $p > 0.1$ ) in Model 4, suggesting that there is no evidence that the abnormal returns of third-party certified CEIs are different from those of self-declared CEIs. Thus H4 is not supported.

## 5. Discussion

In this research we examine stock market reactions to CEIs in China. In contrast to the findings in the Western context, we find that Chinese investors react negatively to CEIs. In other words, unlike investors in Western countries, Chinese investors may believe that CEIs would lower the profitability of a firm, i.e., environmental initiatives and business objectives are likely to be in conflict. Previous research in the US suggests that CEIs lower the operational costs of firms, improving their productivity (see, e.g., Ba et al., 2013; Klassen and McLaughlin, 1996). Through CEIs, firms minimize waste, energy, and material consumption, and reduce environmental compliance costs (Jacobs et al., 2010). By channelling more resources to environmental management, firms can reduce overall operational expenses and improve their corporate images, leading to higher profitability. However, it seems that the same belief is not commonly shared among Chinese investors. Why do Chinese investors view firms' environmental initiatives differently?

Buyaert (2012) explained that Chinese stakeholders as a whole are less concerned about a firm's activities related to corporate social responsibility. With fast economic development in the past decades, Chinese investors expect high growth rates in their invested firms and quick returns from their stock investments. The investment community does not encourage investments in compliance and socially responsible actions, which are considered as a long-term orientation for many Chinese stock investors. Also, the environmental laws, regulations, and requirements are in a state of flux within the country, and are often inconsistently enforced across regions (Zu and Song, 2009; Buyaert, 2012). A firm's long-term environmental orientation might be seen as a risky investment and might not lead to any short-term advantage to the firm. In fact, it has been observed that China's fast economic growth has tended to stimulate risk-taking investments in the country (Li and Tang, 2010;

Buyaert, 2012). A firm's environmental orientation, at such time of dramatic growth in the Chinese economy, is not viewed as attractive to stock investors. Furthermore, given that historically Chinese brands are under-developed and many successful Chinese firms are original equipment manufacturers, supporting brand building through environmental initiatives is considered as an even less attractive option to investors (Li et al., 2013).

As our finding regarding the negative stock market reactions to CEI announcements contradicts the pervasive claim that "it pays to be green" (Endrikat, 2015; Molina-Azorín et al., 2009), one may question the robustness of our results, especially considering the relatively short event window (i.e., three days from days -1 to +1) adopted in our research. To address this concern, we conduct additional analyses on CARs over longer event windows to check the sensitivity of our finding. In particular, we calculate CARs over 5 days (days -2 to +2), 11 days (days -5 to +5), and 21 days (days -10 to +10), respectively, as shown in Table 5. The results show that the mean and median CARs remain negative in these three longer event windows. Moreover, the Wilcoxon signed-rank test is statistically significant ( $p < 0.1$ ) in all these three event windows. Therefore, these additional tests provide further support for our conclusion that investors react negatively to firms' CEI announcements in China.

--- Table 5 about here ---

Although we find negative stock market reactions to Chinese firms' CEI announcements, we do not encourage Chinese firms to behave in environmentally irresponsible ways. In fact, Chinese firms' environmental violation events still have negative effects on their market value (Xu et al., 2012). Moreover, our regression results shown in Table 4 also suggest that stock markets react more positively to Chinese firms' CEI announcements in recent years. Firms thus need to pay more attention to this changing behaviour of Chinese investors in recent years and should not exclude CEI investments from their future business plans.

On the other hand, to encourage more Chinese firms to engage in CEIs, the Chinese government needs to further enhance the cost reduction and revenue gain mechanisms of CEIs in China, which in turn helps change the perception of Chinese investors about CEIs. For instance, the government should continue to redouble enforcement of regulations across different areas in China, encouraging

firms to improve environmental performance to reduce costs, rather than to avoid punishment by moving to other areas with lax enforcement of regulations. Similarly, the government should continue to increase the environmental awareness of Chinese consumers and stimulate green consumption, thus benefiting environmentally responsible firms in terms of revenue gain. We believe that once the cost reduction and revenue gain mechanisms of CEIs become clear in China, investors will favour Chinese firms' CEI investments.

Furthermore, consistent with the finding in the Western context, we find that Chinese investors react relatively more positively (or less negatively) to product-focused initiatives as compared with process-focused initiatives. This shows that, to a certain extent, Chinese investors recognize the reputational effect of environmental concerns through products, but not processes. Gilley et al.'s (2000) study in the US suggested that investors respond more positively to product-focused CEIs due to the reputational effect. They explained that process-focused CEIs have little effect on enhancing a firm's goodwill with stakeholders as consumers often pay scant attention to firms' operations. They maintained that the "potential reputation enhancing benefits of process-driven initiatives are not realized, translating into a negative reaction" (Gilley et al., 2000, p. 1210). Accordingly, it seems that Chinese firms can move strategically to implement product-focused CEIs in order to increase shareholders' value.

Also, consistent with the finding of Jacobs et al.'s (2010) study in the US, we find no significant difference in market reaction to self-declared and third-party certified CEIs. In the Chinese context, the stock market does not positively react even if such CEIs are externally endorsed (e.g., ISO 14001 or environmental awards bestowed by the government organizations). The results reinforce our argument that Chinese investors have less concern for corporate environmental activities, even if such efforts are verified externally.

Unique to the Chinese context, we find that investors react more negatively to CEIs in state-owned enterprises, as compared with privately-owned corporations. Li and Foo (2015) found that the quality of corporate social responsibility (CSR) reporting has a much stronger effect in lowering the capital cost for privately-owned firms. In contrast, the quality of CSR reports, either

voluntary or mandatory, has no effect on the capital cost for state-owned enterprises. State-owned enterprises, which are backed up by the Chinese government, are considered as less risky investments in the stock market. As state-owned enterprises are often protected by the government, mitigating firm risks through environmental initiatives is considered as less attractive. On the other hand, private firms in the Chinese stock market are often controlled by proprietors with diverse backgrounds, making the signalling effect of CEIs relatively important (Li and Foo, 2015).

In China, state-owned enterprises consume more resources from society, including easy access to capital, government subsidies, and policy advantages (Cheung et al., 2015). Nevertheless, state-owned enterprises are also under greater pressure to practise CSR and shoulder environmental responsibilities (Van der Laan Smith et al., 2005). In fact, state-owned corporations in China are not only viewed as business enterprises, they are considered as a government authority of the country's economic and social stability (Li and Foo, 2015). For privately-owned firms, engaging in CEIs or CSR activities can be a way for developing positive corporate images and building political connections with the government, which in turn enhances their public images and reputations in the investment community. However, being state-owned, there is no need to develop government connections through CEIs as all their senior executives are government officials (Cheung et al., 2015). As privately-owned firms are disadvantaged in the marketplace, CEIs are relatively more relevant in building legitimacy, reputation, and confidence in investors (Qian et al., 2015). The stock market thus reacts less negatively to CEIs in private firms.

For state-owned enterprises, social and environmental duties are an accepted part of their corporate responsibility. Qian et al. (2015) maintained that much of the social and environmental responsibilities are concentrated in the state-owned enterprises in China. For CEIs in state-owned enterprises, investors would be doubtful that "too much social responsibility could disadvantage firms economically" (Zu and Song, 2009, p. 109). Environmental initiatives in state-owned firms would probably be considered as a signal that firms need to sacrifice profits to shoulder social burdens as dictated by the government (Cheung et al., 2015). Historically, state-owned enterprises have been bearing various social responsibilities as required by the government, making profit-making a second

priority. For example, state-owned enterprises often have a larger than required workforce to stabilize the job market, absorb price fluctuations, and lower product prices to curb inflation during economic upturns (see, e.g., Markoczy et al., 2013).

In recent years, the Chinese society, including the media and the public, is increasingly aware of the importance of environmental management. We believe that our findings bear some important policy implications. In particular, to motivate firms to take up more environmental responsibilities, it is important to align CEIs with a firm's interest. Such an alignment might involve changing the prevalent view (or at least in the stock market) that environmental protection and a firm's interest are in conflict. This will also rely on government policy to ensure that environmentally-friendly firms are economically advantaged. In this process, the change in the mindset of investors, consumers, and other stakeholders of firms are very important. With internationalization of Chinese enterprises and increasing concern for environmental issues in the country, we believe that there will be some positive changes in this regard for years to come. However, the current scenario does require the attention of both the government and the business community.

Finally, the signalling perspective adopted in our research may offer a fruitful theoretical foundation for future research on CEIs. Signalling theory is suitable for studying CEIs because of the opaque nature of environmental management (Wijen, 2014). In other words, it is not clear whether a CEI, when announced, can benefit the announcing firm financially. In this situation, investors need to rely on other observable signals to interpret the financial consequences of the announced CEI. The signalling perspective is particularly useful in the context of China in which information is more opaque and entities are less accountable (Williams, 2015). Drawing upon signalling theory, researchers can study other interesting questions beyond those addressed in our research. For instance, while our research focuses on investors' reactions to the signals sent by firms announcing CEIs, future research can explore how other stakeholders such as customers, suppliers, and competitors interpret and respond to firms' CEI signals. On the other hand, in addition to the characteristics of firms and CEIs investigated in our research, researchers can examine how the signalling environment in China may moderate stakeholders' reactions to CEIs. For example, stakeholders may react quite differently

to CEIs announced in more polluted areas or industries. Overall, we encourage researchers to adopt the signalling perspective to enrich our understanding of CEIs in general and the Chinese context in particular.

## 6. Conclusions and Limitations

Consistent with the findings in the Western context, environmental initiatives in the business community in China might be economically motivated rather than morally driven (Zu and Song, 2009). However, in the Western context, investors often consider CEIs as an opportunity to streamline operations, reduce waste, and improve corporate image. However, as reflected by the negative stock reactions, Chinese investors view CEIs differently in that they believe environmental initiatives by firms might be in conflict with shareholder interests. Such a conflict is more pronounced when firms pursue process-based CEIs, which has little reputational effect. It is also more serious in state-owned enterprises, which have traditionally been taking on more social responsibility as dictated by the government. Investors might consider CEIs in state-owned enterprises as signals that firms need to sacrifice profits to shoulder more social responsibility.

There are some limitations in our research. First, we consider market reactions to CEIs generally across all industrial sectors. It is possible that market reactions to some technologically breakthroughs in environment-related sectors might be different. For example, in recent years, the Chinese government has encouraged the development of electric vehicles and the market is very likely to react positively to technology development in such an industry. Also, our research focuses on social responsibility for environmental-related issues, rather than environmental technology that is critical to a particular industry (see, e.g., Ba et al., 2013). Second, as China is undergoing rapid economic, social, and technological development, it is possible that the mindsets of consumers and investors will change in the near future. However, our findings should reflect the scenario in China during a period of fast economic development over the past decade. We believe that, by studying stock market reactions to CEIs, we can better understand the perceived values of CEIs in the investment community. This will enable researchers and practitioners to gain a better understanding of the market

values of CEIs, providing important implications for operations management and policy formulation.

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Table 1  
Key variable descriptions.

Variable	Description	Measurement	Data Source	Reference
Process-focused or product-focused CEIs	Whether the CEIs are process-focused or product-focused.	Process-focused CEIs = 1; Product-focused CEIs = 0.	WiseNews	Gilley et al. (2000), Jacobs et al. (2010).
State-owned or privately-owned firms	Whether the firms are state-owned or privately-owned.	State-owned firms = 1; Privately-owned firms = 0.	CSMAR	Chen et al. (2010), Wang and Li (2015).
Third-party certified or self-declared CEIs	Whether the CEIs are third-party certified or self-declared.	Third-party certified CEIs = 1; Self-declared CEIs = 0.	WiseNews	Jacobs et al. (2010), Klassen and McLaughlin (1996).
Firm Size	Size of the announcing firms.	ln(Total Assets)	CSMAR	Flammer (2013), Jacobs (2014).
Firm Profitability	Profitability of the announcing firms.	Return on Assets (ROA)	CSMAR	Flammer (2013), Tang et al. (2016).
Time Trend	When the CEIs are announced.	Year of CEI announcements - 2005	WiseNews	Flammer (2013), Melnyk et al. (2003).
Industry Dummies	Industry of the announcing firms	Binary coding based on the industry classification compiled by the China Securities Regulatory Commission.	CSMAR	Li et al. (2011), Lo et al. (2010).

Table 2

Test results of abnormal returns.

Panel A: Abnormal Returns (ARs)					
Day	N	Mean ARs	Median ARs	t-test	Wilcoxon signed-rank test
-1	556	0.07%	-0.15%	0.784	-0.791
0	556	-0.13%	-0.17%	-1.516*	-2.608***
+1	556	-0.15%	-0.23%	-1.570*	-3.060***
Panel B: Cumulative Abnormal Returns (CARs)					
Days	N	Mean CARs	Median CARs	t-test	Wilcoxon signed-rank test
-1, 0	556	-0.06%	-0.23%	-0.457	-1.516*
0, +1	556	-0.28%	-0.33%	-2.068**	-2.998***
-1, +1	556	-0.21%	-0.31%	-1.221	-1.983**

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  (one-tailed tests).

Table 3  
Correlation matrix.

Variable	1.	2.	3.	4.	5.	6.	7.
1. CARs	1						
2. Firm Size	0.038	1					
3. Firm Profitability	-0.074*	-0.150***	1				
4. Time Trend	0.073*	0.472***	0.005	1			
5. Process-focused or product-focused CEIs	-0.132***	-0.131***	0.145***	-0.098**	1		
6. State-owned or privately-owned firms	-0.133***	-0.072*	0.091**	-0.368***	0.306***	1	
7. Third-party certified or self-declared CEIs	0.066	-0.130***	0.015	0.001	-0.126***	-0.091**	1
Mean	-0.284	24.692	0.111	4.093	-0.374	0.236	0.151
Standard Deviation	3.192	2.103	0.152	2.499	0.484	0.425	0.358

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  (two-tailed tests).



Table 4  
Cross-sectional regression results.

Variable	Model 1	Model 2	Model 3	Model 4
Intercept	5.111 (1.373)	6.032 (1.619)	5.141 (1.381)	5.171 (1.390)
Firm Size	-0.252 (-1.581)	-0.293* (-1.838)	-0.219 (-1.357)	-0.224 (-1.387)
Firm Profitability	-2.055* (-1.818)	-1.958* (-1.740)	-1.938* (-1.731)	-1.917* (-1.713)
Time Trend	0.198*** (2.771)	0.209*** (2.924)	0.132* (1.719)	0.135* (1.755)
Process-focused or product-focused CEIs		-0.839*** (-2.357)	-0.728** (-2.040)	-0.705** (-1.974)
State-owned or privately-owned firms			-1.070*** (-2.549)	1.063*** (-2.533)
Third-party certified or self-declared CEIs				0.510 (1.224)
Industry Dummies	Included	Included	Included	Included
Number of Observations (N)	551	551	551	551
R-square	0.145	0.155	0.166	0.168
Adjusted R-square	0.054	0.063	0.073	0.074
F-value	1.594***	1.681***	1.787***	1.784***

Notes:

1. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  (two-tailed tests for control variables and one-tailed tests for hypothesized variables).
2. t-statistics are in parentheses.

Table 5

Cumulative abnormal returns over longer event windows.

Days	N	Mean CARs	Median CARs	t-test	Wilcoxon signed-rank test
-2, -2	549	-0.27%	-0.22%	-1.183	-1.284*
-5, +5	498	-0.77%	-0.38%	-2.291**	-2.073**
-10, +10	446	-1.14%	-0.57%	-2.206**	-1.775**

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  (one-tailed tests).